T H E

TREATMENT OF DIABETES MELLITUS IN ADULTS

—— b y ——

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1 9 3 0.

This article is the result of 3 years experience as Resident Medical Officer in charge of the Diabetic Department of the Ministry of Pensions at Queen's Hospital, Sidcup.

In the examination of suspected cases of diabetes it is useful to employ a stock case sheet which may of course be altered to suit the individual.

The principal facts to be obtained in such cases are the presence of hunger, thirst or polyuria, a feeling of weakness, loss of weight, pruritus, cramp in legs and arms, impairment of vision, occurrence of gangrene or penetrating ulcers of the extremities, loss of sensation and furunculosis.

Having ascertained these facts a careful physical examination should be carried out paying particular attention to the lungs (in view of possible tuberculosis), the central nervous system and the skin and extremities. This should be supplemented if necessary by an X-ray picture of the chest and a Wassermann test of the blood. In my experience the presence of tuberculosis or syphilis adds greatly to the difficulty of control. In the event of failing vision an examination of the retina should be carried out for diabetic retinitis and haemorrhages and cataract should be looked for also. In the central nervous system the arm and leg reflexes are important

as the severity of a case and the possibility of gangrene may be determined on the absence of knee and ankle jerks.

The elucidation of such cases is of great interest. It often happens that a suggestive clinical history with perhaps a very mild sugar tolerance test or even a test which appears normal, will leave the examiner in some doubt. In such cases the diagnosis may be clinched by the presence of some slight gangrenous change in the toes, some small and persistent ulcer in that region or even a history of repeated furunculosis. At other times when the diagnosis is trembling between mild diabetes and simple glycosuria an examination of the eyes may show diabetic retinitis or haemorrhages. It sometimes happens too, that even after exhausting all the routine tests one is still in doubt. In these cases the therapeutic test may prove the only solution. If after a period of treatment with restriction of carbohydrate and with or without insulin the patient shows a gain in weight, in strength and general well being, it is safe to conclude that the condition has been one of mild diabetes as restriction of diet always results in deterioration or at least in lack of improvement in cases of renal glycosuria. At this point it may be well to differentiate between the two type of diabetes noted in adults. There is the severe type noted in the young adult in which eye changes and trophic disturbances are absent and only

thirst, hunger, polyuria and progressive emaciation are present, and the senile type in which obesity may be accompanied by cataract, retinitis, furunculosis, muscular cramps, pruritus, and gangrene of the feet. In the first group the blood sugar figures are high and ketonuria and threatened coma are common while in the second group the blood sugar figures may not be much above normal and easily controlled by a little restriction of diet and a small dose of insulin, though troublesome and very obstinate terminal gangrene may persist.

The diagnosis of a case of diabetes would at first sight appear to be easy. The patient reports with some symptom such as polyuria or pruritus and an examination of the urine shows the presence of a reducing substance with Fehling's solution. He is told he is suffering from diabetes and the diagnosis is made. A hasty pronouncement made on the presence of urine sugar has in my experience been the initial step in a long trail of mental depression and worry, with resulting loss of useful activity and the production of an "invalid habit", which is afterwards difficult or impossible to eradicate. At this early stage I would plead therefore that the diagnosis and treatment of

diabetes should be based wherever possible on blood sugar estimations as well as on urine findings. In addition it is wise to remember that far more importance should be paid to the presence or absence of ketone bodies such as acetone and diacetic acid. It has been noticed particularly that the case of "diabetes" discovered by accident in routine urinalysis in an otherwise healthy individual is usually a case of renal glycosuria.

In the first instance attention should be directed to the patient's own complaints. A history of loss of weight, of hunger, of weakness, of failing vision, of muscular cramp, of ulceration or gangrene of the lower extremities, is important. One or all of those symptoms with glycosuria and acetonuria should point to the necessity for a blood sugar estimation. And at this stage one must emphasize the necessity for the co-operation of a good laboratory and the services of a technician who is thoroughly acquainted with the estimation of blood sugar. Whatever the method and whether that of McLean or the colorimeter method, one must be able to depend completely on the accuracy of the results supplied.

Having made a tentative diagnosis clinically the blood sugar should be examined at once. If this can

be done before any dietetic restrictions have commenced so much the better, the picture will not be blurred by extraneous conditions. Let us say, for example, that the result obtained was 0.175% taken a couple of hours after an ordinary meal. We are here faced with the problem that it may be simply the normal rise in blood sugar following a meal and that the estimation has been done at the summit of normal blood sugar. If the figure obtained is 0.200% or higher, the position is easier as the probability is that we are dealing with a case of diabetes though it must not be forgotten that in some individuals a lag in blood sugar absorption may raise the blood sugar level above the normal 0.175%.

At the same time the urine should be examined for sugar and ketone bodies. If these bodies are present and there has been no dietetic restriction of any kind, it may be concluded that diabetes is present. At this stage it may be well to mention that the patient should be questioned re the taking of any coal tar derivative drugs, such as aspirin, etc., as a colour reaction, similar to that of acetone and diacetic acid, may be obtained in the urine of such patients.

The question of eclampsia and eclamptic vomiting and the possibility of disordered liver metabolism due to other causes should be kept in mind.

If the blood sugar results and the examination of the urine are still inconclusive, a sugar tolerance test may be performed. 50 grammes of glucose in water are given fasting and blood sugar tests are performed before taking the glucose, half an hour afterwards, and at half hourly intervals till five tests in all have been performed. The quantity of urine sugar and the presence or absence of acetone or diacetic acid are ascertained in the urine specimens passed just before or after each blood letting.

For the results obtained a graph is plotted and it may be concluded that a blood sugar curve rising above 0.175% and remaining at or above that height at the end of 1½ hours is diagnostic of diabetes.

But the diagnosis must not be summarily made on laboratory findings alone, nor must the severity of the case be judged on the curve obtained. This will be discussed in a later paragraph.

Having decided that the case is one of diabetes the next thing is the treatment. We have been in the habit of using the 14th. day diet of McLean's scale as the standard and with Insulin and the addition or subtraction of bread or fats, giving the patients, if possible, a calory value of 2000 daily and endeavouring to keep the weight near or at the standard weight for

the particular height and age group according to the scale in use by most insurance companies. In addition an attempt is made to keep blood sugar values at a normal figure or if that is not possible to so control them that the fasting figure and the figure four hours after a meal and Insulin are at least normal. Glycosuria unless excessive, is only regarded as a useful warning against hypoglycaemia, while if possible ketonuria is prevented.

There are two schools of treatment in this disease. The first endeavours by restriction of diet and a small quantity of Insulin to keep the patient's blood sugar at a normal level and his urine sugar-free without paying too great attention to his working capacity or the presence or absence of ketonuria.

The second school aims at control of the blood sugars, the elimination of ketonuria and the building up of the patient's weight. This implies a higher scale of diet and a corresponding increase in insulin. This means that the patient is given a more liberal scale of food and he is less tempted to dietetic indiscretions than his neighbour. The sense of well-being obtained by a square meal, the ability to perform his ordinary duties and the freedom from irksome restrictions make life more pleasant to the patients and

compensates them for the slightly increaseddose of insulin. The life of the diabetic can never be normal and the more nearly it approaches normal the happier the patient. The results obtained with this line of treatment seem so far to justify it as many patients have now been carrying on a fairly normal existence as regards work and play for periods of ten years and over on this regime.

In order to carry out this control better a system of charts in which the weekly weight, the quantities of carbohydrate in grammes, the insulin dosage of units, the blood sugar level, the presence of glycosuria and acetonuria and the calory value are all indicated on a definite graph principle, has been adopted.

It is thus possible to tell at a glance the patient's progress from day to day and his re-action to treatment. By adopting the principle that the metabolism of fats depends on the combustion of carbohydrate and that the addition of extra insulin and extra carbohydrate with, if necessary, some restriction in total fat intake, will prevent ketosis, it is usually possible after some days, weeks, or even months, of experiment to strike the diet and insulin dose which suits the particular patient and maintains weight while preventing ketonuria.

As a matter of convenience the blood sugar estimations are made fasting and two and four hours after the morning meal which is preceded by the first insulin dose of the day. The second insulin dose is given before the evening meal which may be taken at four or seven p.m. An endeavour is made to keep the fasting blood sugar normal in the region of 0.100% and also the one taken four hours later. If the two hour figure is normal so much the better, but in some patients a "spike" occurs at that time quickly dropping to normal in two hours, evidently due to some delay in absorption by the liver. In somecases it happens that in spite of a large dose of insulin taken very late in the evening the fasting blood sugar taken at 8 a.m. remains high. In such cases it has been the custom to give a small dose of insulin at 6 a.m. in addition, the idea being to keep the blood sugar figures low over as long a portion of the 24 hours as possible.

The exhibition of a high dose in the evening to obviate this is often followed by hypoglycaemia during the night, and as this should be avoided, the early morning dose has been adopted. The insulin is given fifteen minutes before the meal except in the case of the small morning dose in very severe cases which is often given on an empty stomach, though in the case of a nervous

patient it is often wise to give a half ounce or less of bread to avoid the fear of hypoglycaemia. It has been noted in several cases that by this early morning method the daily quantity of insulin necessary is often less than when two large doses only are given. In a very severe case it may be necessary to give a further dose before the mid-day meal as well.

The ideal to be attained is of course a normal blood sugar figure at all times, the absence of glycosuria and freedom from ketonuria. If this ideal can not be attained what should be attempted? Firstly, the question of glycosuria should be neglected. Many patients who are perfectly controlled as regards blood sugar and ketonuria will always show urine sugar. It seems as if in some cases the diabetes had left the patient with a subnormal renal threshold and an attempt to keep the urine sugar free may lead to unnecessary dietetic restrictions or in an insulin case to hypoglycaemia. A trace of urine sugar is a rough guide to enable the patient or his medical attendant to keep a lookout for hypoglycaemia in the absence of blood sugar tests. Next comes the question of ketonuria. It is always well to try and prevent this as it is felt that the presence of acetone will in the long run be detrimental to the patient and may be responsible for the

onset of eye symptoms such as retinitis or cataract or the occurrence of peripheral neuritis and gangrene. I am convinced that the patient who maintains his weight and working capacity with a raised blood sugar and no ketonuria will do better in the long run than the case where blood sugars are low but where ketonuria is constant. There are, however, certain patients who have shown a constant ketonuria over a period of years without any apparent disadvantage so far. In one such case I was able to demonstrate by raising the insulin dosage and increasing the carbohydrate ration that this condition was not insurmountable. However, this particular patient after a few hypoglycaemic attacks on leaving hospital reverted to the old regime of lower carbohydrate and lower insulin dosage with a return of ketonuria without any apparent ill effects. In some cases with a persistent ketonuria it has been the custom to prescribe a diet very high in carbohydrate and low in fats, such as the following.

I have also appended copy of McLean's 14th. Day diet.

The following list shows the vegetables included in Group A. and the alternative groups that may be substituted.

—— GROUPS OF VEGETABLES. ——

GROUP A.	GROUP B.	GROUP C.	GROUP D.	GROUP E.
8 ounces or	6 ounces or	4 ounces or	2 ounces or	1½ ounces.
Cabbage	Beetroot	Oranges	Green Peas	Bananas.
Cucumbers	French Beans	Pineapple	Raspberries	Potatoes
Sea Kale	Onions	Strawberry	Cherries	Plums
Mushrooms	Carrots	Cranberries	Artichokes	Prunes
Sprouts	Turnips	Peaches	Currants	
Tomatoes		Watermelon	Parsnips	
Lettuce		Gooseberries	Apples	
Spinach			Pears	
Watercress				
Cauliflower				
Celery				
Marrow				
Rhubarb				
Endive				
Asparagus				
Leeks				
Radishes.				

Diet	Ozs.	C.	P.	F.	Heat Value	Insulin dose before each meal.
		In grammes.				
BREAKFAST:						
Milk	3	4.5	3	3	57	
Egg (1)	-	-	6	6	80	
Bread	1	15	2	-	75	
Oatmeal	1	18	4	2	112	
Cream	1	1	1	10	98	
LUNCH:						
Butter	½	-	-	11.5	106	
Egg (1)	-	-	6	6	80	
Bread	1	15	2	-	75	
Milk	2	3	2	2	38	
Cream	1	1	1	10	98	
TEA - 4 p.m:						
Bread	2	30	4	-	150	
Milk	3	4.5	3	3	57	
Chicken	2	-	12	2	68	
Egg (1)	-	-	6	6	80	
Cream	½	0.5	0.5	5	49	
SUPPER - 7 p.m.						
Tea						
Milk	1	1.5	1	1	19	
Bread	1	15	2	-	75	
Butter	½	-	-	11.5	106	
Egg (1)	-	-	6	6	80	
Cream	½	0.5	0.5	5	49	
						MILK DIET.
TOTAL ..		109.5	62	90	1552	

Diet	Ozs.	C.	P.	F.	Heat Value	Insulin dose before each meal.
		In grammes.				
BREAKFAST.						
Tea						
Milk	1	1.5	1	1	19	
Bacon	2	-	6	36	360	
1 Egg	-	-	6	6	80	
Butter	½	-	-	11.5	106	
Oatmeal	1	18	4	2	112	
Veg: Group) "A" 5%)	5	5	-	-	20	
LUNCH:						
Tea						
Meat	3	-	18	9	153	
Potatoes	1	6	.5	-	30	
Bacon or Ham	1	-	3	18	180	
Butter	½	-	-	11.5	106	
Veg: Group) "A" 5%)	5	5	-	-	20	
T E A:						
Tea						
Milk	½	.75	.5	.5	9.5	
Meat	3	-	18	9	153	
Bread	1	15	2	-	75	
Cheese	1	-	8	10	130	
Butter	½	-	-	11.5	106	
Veg: Group) "A" 5%)	4	4	-	-	16	
SUPPER:						
Tea						
Milk	½	.75	.5	.5	9.5	
Butter	1	-	-	23	212	
Cheese	1	-	8	10	130	
1 Egg	-	-	6	6	80	
Veg: Group) "A" 5%)	5	5	-	-	20	
Bran Biscuits & Olive Oil						
TOTAL		61	81	165.5	2127	14th. DAY.

When the ketonuria has been overcome the diet is gradually changed to a higher fat and lower carbohydrate ratio and while some cases never seem able to tolerate this, many on the other hand do well and as a result are able to tolerate a fat content which they were unable to do at the commencement of treatment. It would seem as if the function of fat metabolism has recovered after the period of rest.

With regard to the use of the German compound Synthalin, I have no great experience. It was given to one patient of a highly neurotic temperament as it was thought that the dosage by mouth would obviate the use of hypodermic injections. It appeared to control the blood sugar and to have no ill-effects, but it must be pointed out that in this particular patient good control could be obtained by diet alone under hospital conditions. It was not continued in view of the mass of adverse literature from South America in which the results obtained were said to be at the expense of poisoning the liver substance. A second case did fairly well as regards control but the presence of myocarditis of syphilitic origin was considered to contraindicate its use and the patient reverted to insulin. His death shortly afterwards, after a period of insulin treatment, was probably a result of the cardiac condition and not connected with synthalin. The

third case has now been taking synthalin for some time and while there have been no untoward results, the control is not so perfect as that under insulin.

Such a small series of cases, however, is not enough to give a dogmatic opinion on.

With regard to complications, the list should be headed with diabetic coma. The clinical signs found here are unconsciousness, air hunger and cardiac failure. The diagnosis can be clinched by the presence of acetone and diacetic bodies in the urine as shown by Rothera's and Gerhardts tests and sometimes, though not always, by glycosuria and hyperglycaemia up to 0.300% or 0.400%. Before commencing treatment it is well to have facilities for testing the blood sugar at one or two hour intervals throughout the day and night. On first examining such a case and having ruled out the presence of other causes of coma, a blood sugar test and a urine specimen (catheter if necessary) should be obtained. An enema should be given to clear out as much of the toxin as possible by that route, and then if sugar be present in the urine and a high percentage in the blood, 20 to 40 units of Insulin should be given and the blood and urine tested again in a couple of hours. We now come to the vexed question of whether to administer sugar before the insulin or not. If the patient has a high blood sugar and much glycosuria it hardly seems rational to add to his labour by giving more sugar though many authorities advocate this. In

the presence of an intense ketonuria with little or no urine sugar and a blood sugar of moderate height it is certainly necessary to give glucose by mouth, by nasal catheter or by intramuscular injection as is required, but in the early stages at least of a case with hyperglycaemia and much glycosuria, it does not appear so necessary. I am aware that the orthodox regime is to give sugar in practically all cases, but I would submit that there are cases in which it can be dispensed with. The exhibition of sodium bicarbonate does not appear to have great favour but I consider that alkaline sodium phosphate has a definite value in combating the ketosis. The use of insulin with sugar in the later stage when the blood sugar is beginning to fall should be continued until the patient recovers consciousness and till the urine is free of ketones. It will probably be necessary also to continue a fat-free diet for a day or two until the patient is again normal. It may also be mentioned here that the cardiac tone should be maintained by camphor in olive oil injections and digitalis or strophanthin as I have seen a case in which good chemical results as regards low blood sugar and a much decreased ketosis were nullified with a fatal termination due to cardiac failure.

Next in order of complications we may consider hypoglycaemia, the condition due to an overdose of Insulin. The clinical picture here varies according to

the severity of the reaction. In mild cases all that may be noted is a slight feeling of hunger or faintness. If the process continues there is marked perspiration and in some cases patients have described a muscular cramp. If the condition continues beyond this state there is a phase of mental unbalance in which the patient may laugh, cry, become extremely pugnacious or lachrymose. This stage is usually followed by unconsciousness or partial unconsciousness, in which there is evidently some cramp of the fingers as the patient may often be observed to clasp the fingers of one hand with the other and endeavour to "crack the knuckles" as it were. It must be remembered, however, that some patients pass almost directly into unconsciousness without any of the above mentioned symptoms. The experienced sister or hospital orderly soon learns to detect the facial expression in these cases and is frequently able to warn a patient of hypoglycaemia before he has noted it himself. If the blood sugar be taken in these cases it will be found in the region of .040% or below, though one case was noted with complete absence of blood sugar without any very marked distress.

Having diagnosed the condition the remedy lies in the prompt re-establishment of normal glycaemia. In the mildest cases the administration of a small piece of bread, a couple of lumps of sugar, some toffee

or any other convenient source of carbohydrate is all that is necessary. In a more severe case syrup in water or half to one ounce of glucose may be given as a drink. If the patient is unable to drink the solution normally it may be administered by nose, a No.12 rubber catheter with a funnel being used. In unconscious states or in the absence of result from dosage by mouth a quicker method is the production of glycogenolysis by the hypodermic administration of 7 minims of 1/1000 Solution of adrenalin. This causes a quick recovery as a rule. It is truly remarkable to see the struggling maniac or the case of stertorous coma sitting up in a few seconds and to watch the light of intelligence dawning once more. These attacks in many cases leave no after effects, but as a rule there is severe headache for an hour or two. It is to be noted that in some severe cases of diabetes where there has been hyperglycaemia over a long period, the return of the blood sugar to the normal level may be followed by hypoglycaemia. The whole organism has apparently adjusted itself to living at a level above the normal and any sudden drop is followed by the same symptoms as a drop below the normal.

Diabetic gangrene and perforating ulcers of the foot are best treated by rest in the first instance. In the case of the small perforating ulcer the redundant skin should be cut away and the ulcer dressed

with a gauze swab wrung out of surgical spirit.

In the case of actual gangrene a dry dressing may be used or if the discharge is very offensive, a charcoal poultice. I would like to mention here the extreme value of radiant heat and ultra violet light in this condition. A recent case in which the condition of gangrene of the toes was such as to suggest early amputation of the foot by a leading surgeon was completelyhealed by almost constant radiant heat during the daytime plus the application of local ultra violet therapy. At the same time the insulin dosage was raised to the patient's extreme tolerance and was kept at that level despite occasional hypoglycaemia. The diet was also adjusted to prevent ketosis. It may be mentioned that in this case there was no rise of temperature throughout, which strengthened the desire to avoid amputation.

Furunculosis, a very common and annoying accompaniment of diabetes, often clears on insulin treatment alone. In addition to this, autogenous vaccines, colloidal tin preparations, and stock vaccines, have been tried, with or without the addition of a teaspoonful of yeast in beer taken three times a day. I am inclined to think, however, that the vigorous treatment of the diabetes is the best treatment for the other also. In

the event of carbuncle formation good results may be obtained with continuous radiant heat, plus the application of a fomentation of a saturated cream of magnesium sulphate and glycerine during the night. In acute cases surgical intervention may be necessary also.

The maddening itch of pruritus of the feet and ankles which is such a misery to elderly patients, may be alleviated by bathing the feet last thing at night in a strong soda footbath followed by calamine lotion liberally applied. The general pruritus usually clears up as the general condition improves.

Cramp is probably best relieved by massage and radiant heat. It usually disappears with the control of the general condition.

For the eye conditions little can be done apart from vigorous general treatment.*

Phimosis and balanitis are not troublesome in the well treated case, but may require slitting of the prepuce or circumcision.

With regard to carious teeth, they should be treated and the mouth rendered as healthy as possible. In this instance it is wise to carry out any treatment involving extractions where facilities can be obtained

* Cammidge B.M.J. Nov 16. 1929. Section of Ophthalmology Royal Society of Medicine recommends calcium lactate.

for frequent blood sugar estimations as the treatment with its stirring up of latent sepsis may be responsible for a considerable rise in blood sugar requiring insulin adjustment. I have also seen a dangerous degree of anaemia following dental extractions in a very debilitated diabetic. Fortunately, the condition reacted to liver powder and actino therapy without any untoward results.

Tuberculosis either pulmonary or of any other system, may be treated in the usual way, i.e., fresh air, rest, actino-therapy and good feeding. The diet should be as nourishing and generous as possible and the insulin dose raised until a good control is obtained. It may be mentioned here that subjects of tuberculosis tolerate enormous doses of Insulin and practically never show hypoglycaemia. This is important as the night sweats of phthisis may be confused by the inexperienced with those of hypoglycaemia with resulting dropping of the insulin dosage. It may be assumed in a case of tuberculosis that the last complication to be thought of is hypoglycaemia. There is a preparation "Angiolymphe" given in intramuscular doses 1 ampoule every day or second day until twelve have been given, then followed by a week's rest, which appears to be of some value in tuberculosis. A

patient, thin and hypochondriac, with a positive spit and active signs in the lungs, has gained his former weight and condition, the sputum has become negative, and on the last examination there were no signs in the lungs. This was accomplished by generous diet, high insulin dosage, actino therapy and several courses of "Angiolymphe" injections. The mental change is also striking as the patient is now hale and hearty and very little concerned about his health except for satisfaction as to his continued fitness. The intramuscular injection of colloid calcium appears to be useful in those cases also. I am convinced however that the vigorous treatment of the diabetes is an important factor in such cases.

With regard to febrile disturbances such as influenza, pneumonia, etc., the aim should be to prevent ketonuria and to keep the blood sugar as near normal as possible. Hence it is important to increase the Insulin dose even though the diet may have been cut down. A good working rule for such cases is a moderate glycosuria with complete absence of acetone and diacetic acid from the urine. The patient should take his carbohydrate in the form of bread and milk, or a glucose lemonade, and as soon as more food can be tolerated he may be given the "milk diet" already men-

tioned for a few days and then gradually changed to his original diet.

Before proceeding to give some examples of sugar tolerance tests I would like to state a few facts observed in this connection.

(1) The curve obtained in a case of renal glycosuria which has previously been on a restricted carbohydrate diet will resemble the curve of true diabetes.

(2) This curve of apparently true diabetes will be altered by the giving of unrestricted carbohydrate to a normal curve.

(3) If there is not sufficient time to try a patient who is suspected of renal glycosuria on an unrestricted diet, a series of sugar tolerance tests performed on three successive days will show a return to the normal on the third day.

(4) In a case of clinical diabetes where the first of a series of 3 tests on ordinary diet shows a normal curve, the third curve will often be a diabetic one. The excess carbohydrate given on three successive days has "broken down" the resisting power of the pancreas, as it were.

In the following series of cases 50 grammes of glucose were given by mouth after an overnight fast of 12 to 13 hours and blood and urine sugar specimens were taken at half hourly intervals.

E X A M P L E S: (a)

Pte. J., a man of childish mentality suffering from quiescent fibroid phthisis and glycosuria.

28/11/23 Test carried out on a diet containing 62 grammes of carbohydrate daily.

	Blood Sugar.	Urine Sugar.
Fasting	.060%	
½ hour	.110%	Trace
1 hour	.190%	1.6%
1½ hour	0.175%	1.9%
2 hours	0.110%	1.7%

27/8/28 following unrestricted diet since 26/11/23:-

	Blood Sugar.	Urine Sugar.
Fasting	.055%	1.0%
½ hour	.080%	2.1%
1 hour	.085%	1.95%
1½ hours	.075%	1.9%
2 hours	.075%	1.2%

28.8.1928 as above.

	Blood Sugar.	Urine Sugar.
Fasting	.050%	Trace
½ hour	.080%	Nil
1 hour	.080%	1.6%
1½ hours	.075%	Nil
2 hours	.050%	1.1%

Blood Sugar.		Urine Sugar.
Fasting	.055%	1.0%
½ hour	.080%	2.1%
1 hour	.085%	1.95%
1½ hours	.075%	1.9%
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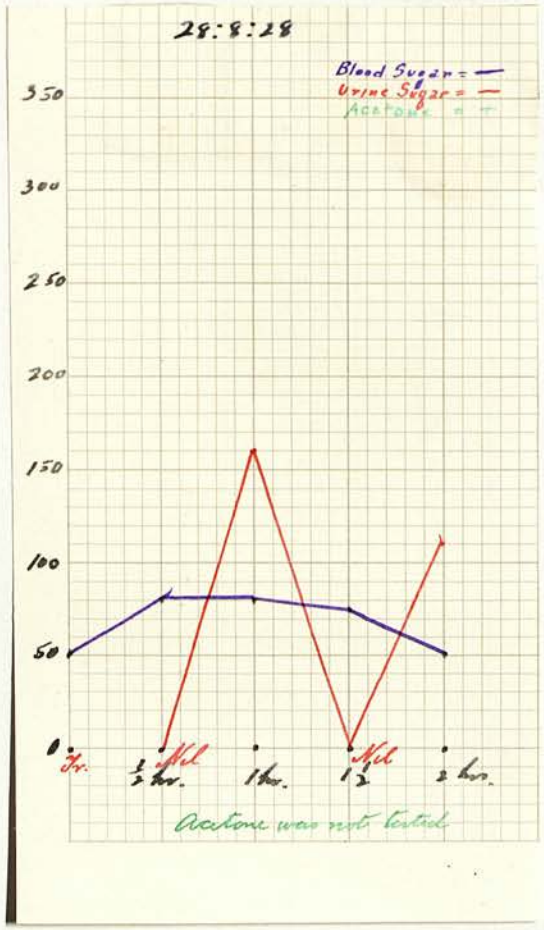
28.8.1928 as above.

Blood Sugar.		Urine Sugar.
Fasting	.050%	Trace
½ hour	.080%	Nil
1 hour	.080%	1.6%
1½ hours	.075%	Nil
2 hours	.050%	1.1%



29.8.28.

Fasting	.065%	Trace
½ hour	.055%	No specimen
1 hour	.060%	.85%
1½ hours	.055%	Trace
2 hours	.040%	No specimen

No acetone present during the last series of tests. Note that the curve simulating true diabetes on restricted diet has become normal after unrestricted diet.

(b).

Pte. F., a stout young man who complained of pruritus all over body and cramps in knees and calves.

15/1/25. On ordinary diet since 3/12/24.

Fasting	.100%	Trace
½ hour	0.130%	1.7%
1 hour	0.155%	2.5%
1½ hours	0.140%	2.5%
2 hours	0.090%	2.1%

29.8.28.

Fasting	.065%	Trace
½ hour	.055%	No specimen
1 hour	.060%	.85%
1½ hours	.055%	Trace
2 hours	.040%	No specimen

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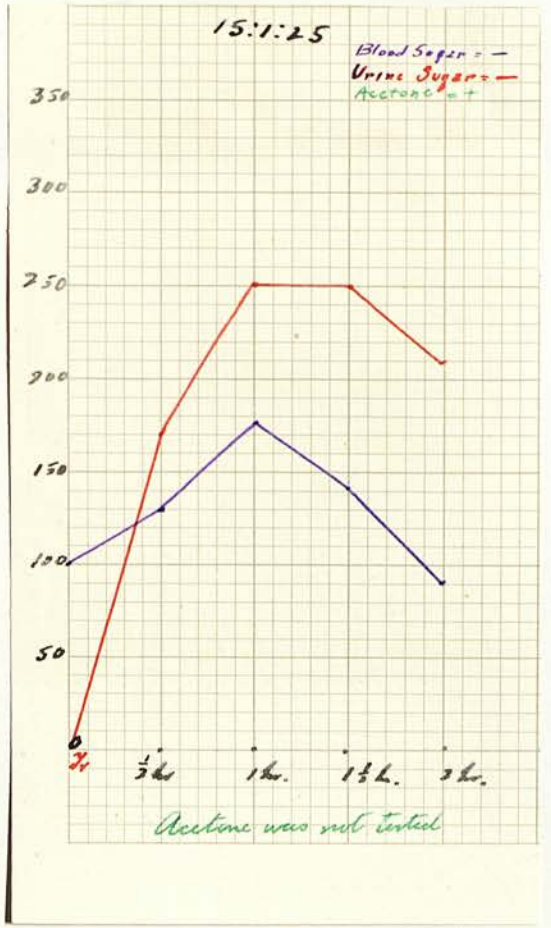
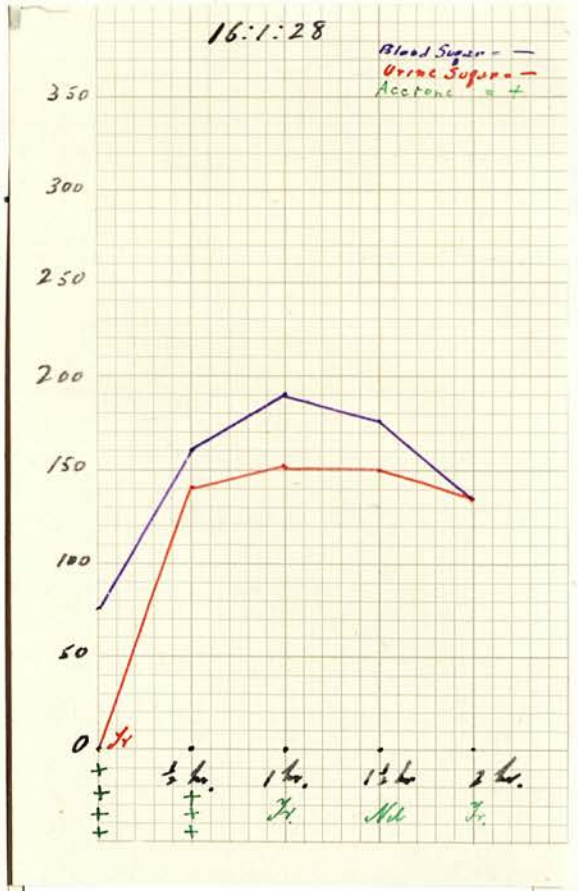


16/1/28. After a diet containing 50 grammes of carbohydrate for 7 days and a restricted diet (carbohydrate content unknown) for some months previously.

	Blood Sugar	Urine Sugar.	Acetone.
Fasting	0.75%	Trace	+ + + +
½ hour	0.160%	1.4%	+ + +
1 hour	0.190%	2.0%	Trace
1½ hours	0.175%	2.0%	Nil
2 hours	0.135%	1.35%	Trace

Note the disappearance of ketosis due to the ingestion of glucose.



15/2/28. After ordinary diet since 17/1/28.

Fasting	.090%	Trace	Nil
½ hour	.130%	2.3%	Nil
1 hour	.110%	2.5%	Nil
1½ hour	.125%	2.0%	Nil
2 hours	.115%	1.75%	Nil

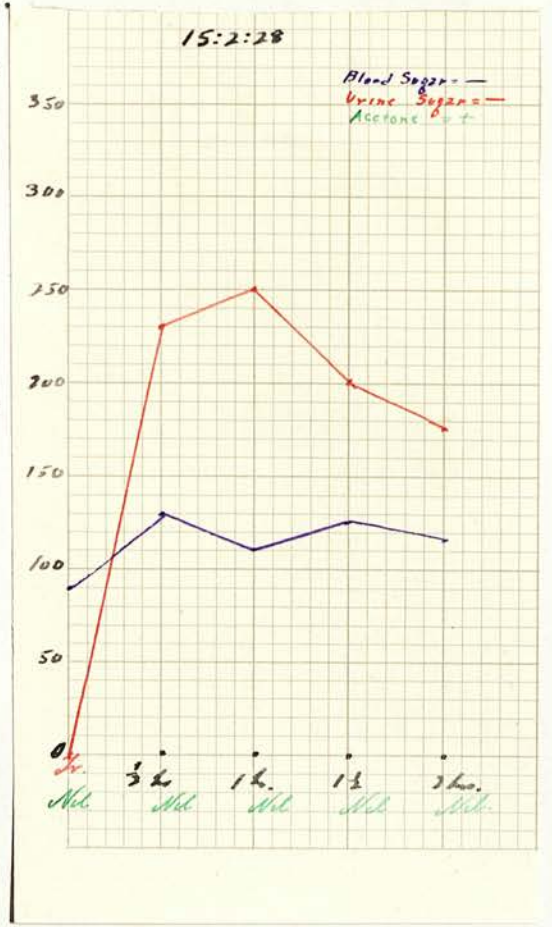
16/1/28. After a diet containing 50 grammes of carbohydrate for 7 days and a restricted diet (carbohydrate content unknown) for some months previously.

	Blood Sugar	Urine Sugar.	Acetone.
Fasting	0.75%	Trace	+ + + +
½ hour	0.160%	1.4%	+ + +
1 hour	0.190%	2.0%	Trace
1½ hours	0.175%	2.0%	Nil
2 hours	0.135%	1.35%	Trace

Note the disappearance of ketosis due to the ingestion of glucose.

15/2/28. After ordinary diet since 17/1/28.

Fasting	.090%	Trace	Nil
½ hour	.130%	2.3%	Nil
1 hour	.110%	2.5%	Nil
1½ hour	.125%	2.0%	Nil
2 hours	.115%	1.75%	Nil

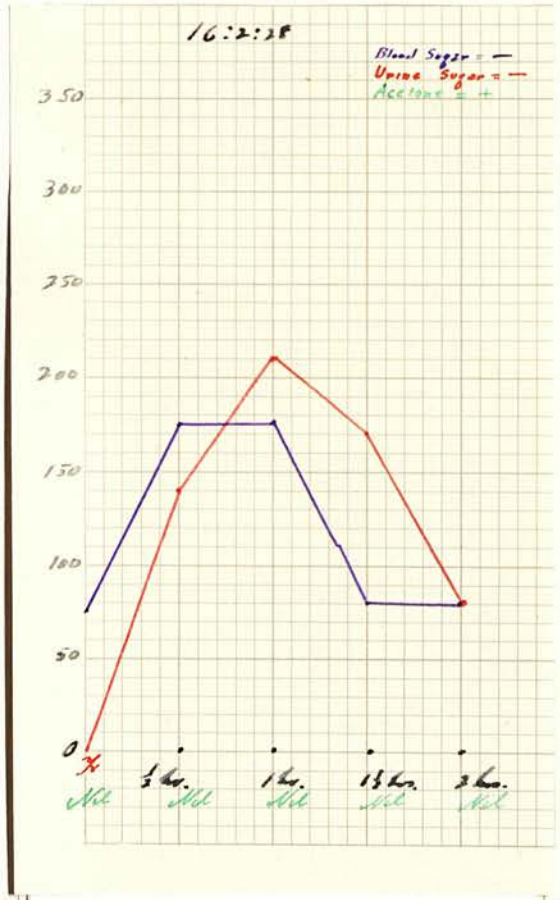


16/2/28. As above.

Fasting	.075%	Trace	Nil
½ hour	.155%	1.4%	Nil
1 hour	.155%	2.1%	Nil
1½ hours	.080%	1.7%	Nil
2 hours	.080%	.8%	Nil

17/2/28. As above.

Fasting	.065%	Trace	Nil
½ hour	.160%	1.65%	Nil
1 hour	.130%	1.25%	Nil
1½ hours	.115%	1.0%	Nil
2 hours	.080%	Trace	Nil

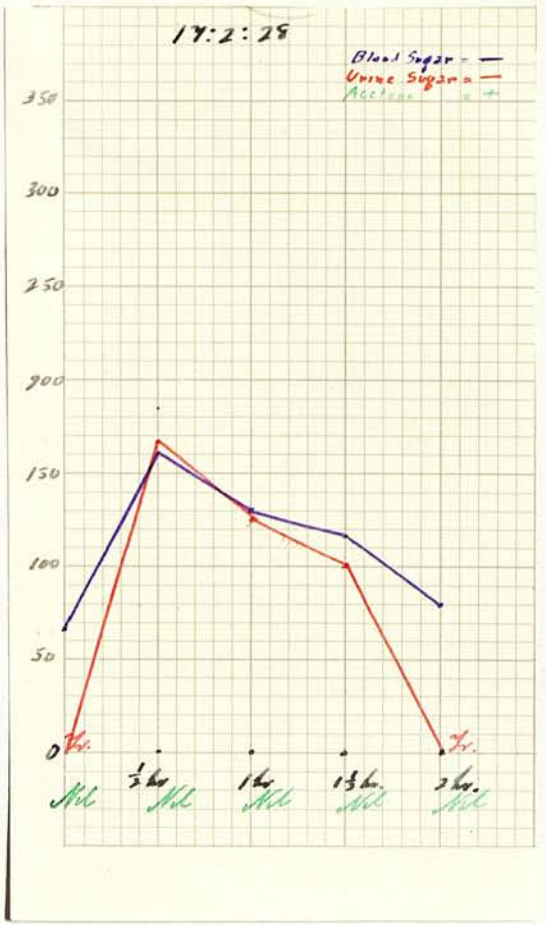


16/2/28. As above.

Fasting	.075%	Trace	Nil
½ hour	.155%	1.4%	Nil
1 hour	.155%	2.1%	Nil
1½ hours	.080%	1.7%	Nil
2 hours	.080%	.8%	Nil

17/2/28. As above.

Fasting	.065%	Trace	Nil
½ hour	.160%	1.65%	Nil
1 hour	.130%	1.25%	Nil
1½ hours	.115%	1.0%	Nil
2 hours	.080%	Trace	Nil

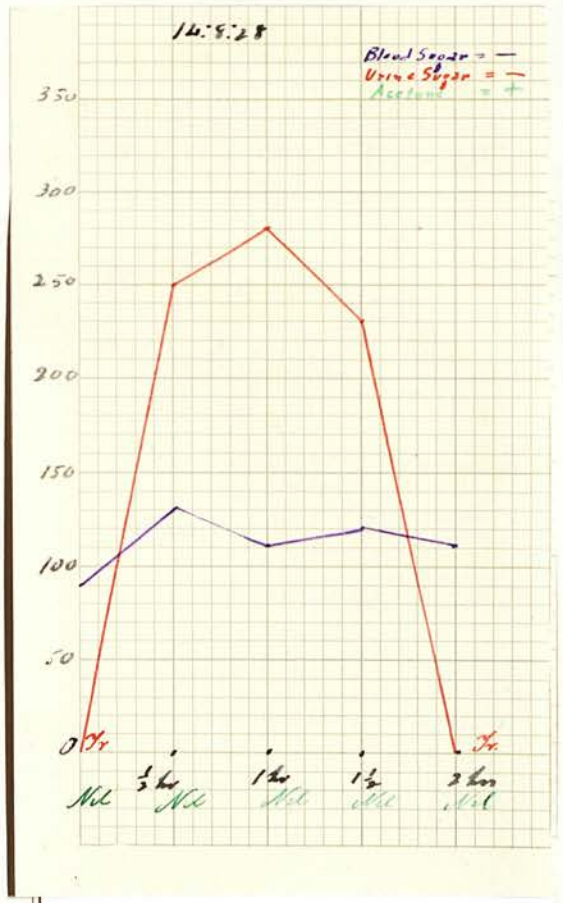


14/8/28. On ordinary diet since 17.1.28.

Fasting	.090%	Trace	Nil
½ hour	.130%	2.5%	Nil
1 hour	.110%	2.8%	Nil
1½ hours	.120%	2.3%	Nil
2 hours	.110%	Trace	Nil

15/8/28. As above.

Fasting	.075%	Nil	Nil
½ hour	.150%	2.5%	Nil
1 hour	.150%	3.3%	Nil
1½ hour	.085%	2.5%	Nil
2 hours	.085%	.65%	Nil

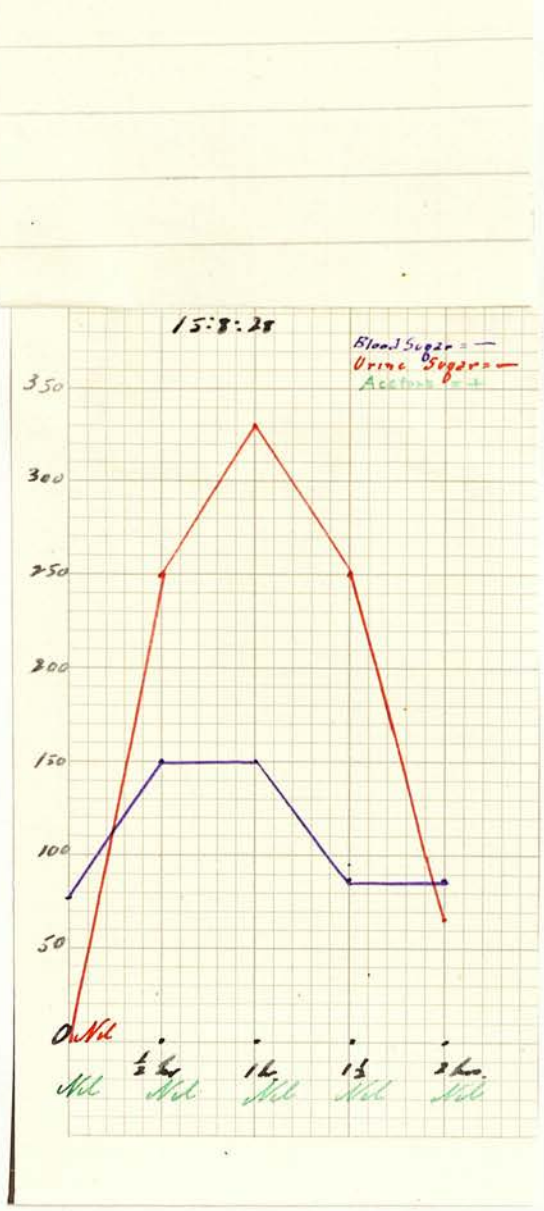


14/8/28. On ordinary diet since 17.1.28.

Fasting	.090%	Trace	Nil
½ hour	.130%	2.5%	Nil
1 hour	.110%	2.8%	Nil
1½ hours	.120%	2.3%	Nil
2 hours	.110%	Trace	Nil

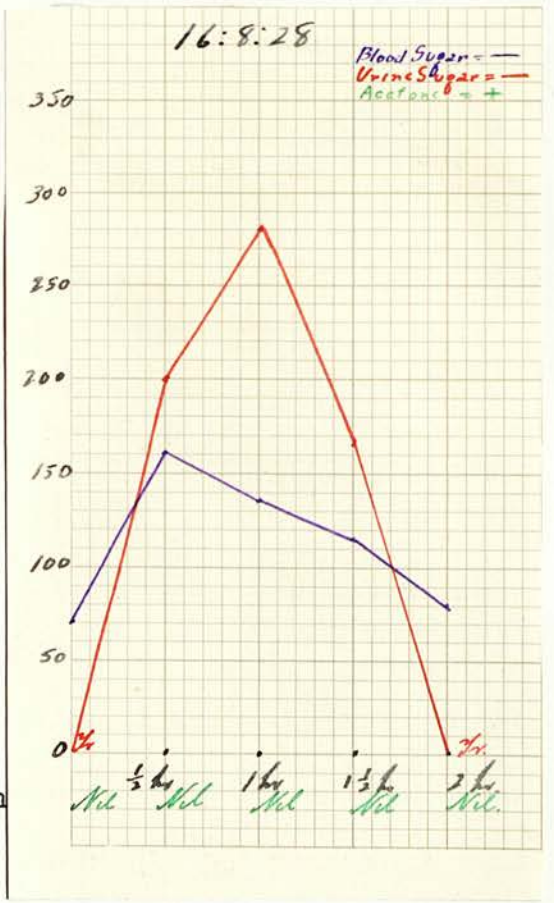
15/8/28. As above.

Fasting	.075%	Nil	Nil
½ hour	.150%	2.5%	Nil
1 hour	.150%	3.3%	Nil
1½ hour	.085%	2.5%	Nil
2 hours	.085%	.65%	Nil



16/8/28. As above.

Fasting	.070%	Trace	Nil
½ hour	.160%	2.0%	Nil
1 hour	.135%	2.8%	Nil
1½ hrs	.115%	1.65%	Nil
2 hours	.080%	Trace	Nil



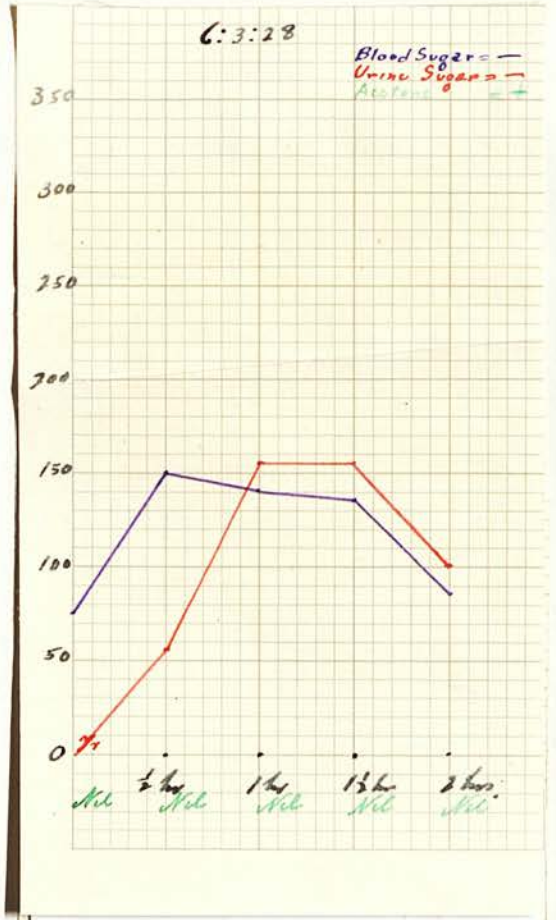
This series comparing (a) and (b) shows the simulation of the diabetic curve under restricted diet and the return to normal on ordinary diet, in renal glycosuria.

(c).

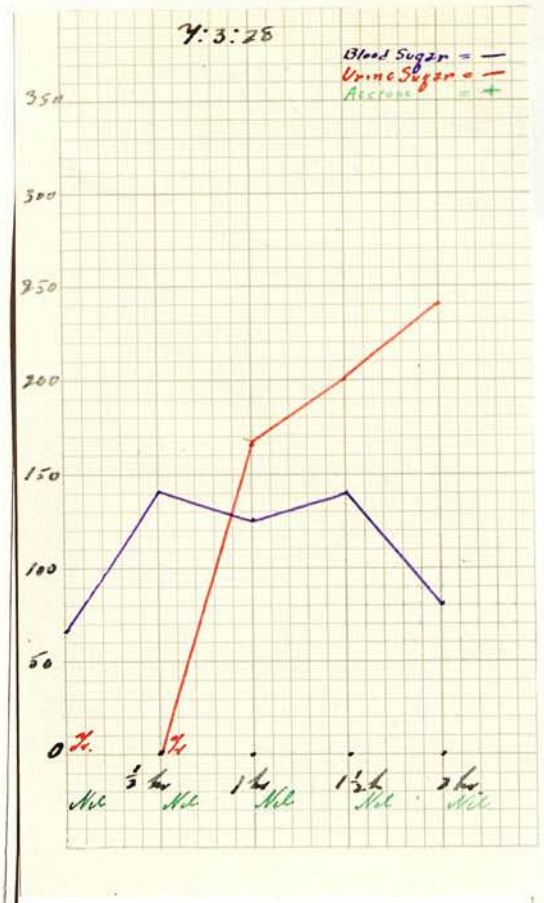
Mr. M. A Case of renal glycosuria with pulmonary syphilis.

A series of sugar tolerance tests performed on 3 successive days, following 50 grammes carbohydrate for 7 days.

6/3/28.			
Fasting	.075%	Trace	Nil
½ hour	0.150%	0.55%	Nil
1 hour	0.140%	1.55%	Nil
1½ hours	0.135%	1.55%	Nil
2 hours	0.085%	1.00%	Nil
7/3/28.			
Fasting	0.065%	Trace	Nil
½ hour	0.140%	Trace	Nil
1 hour	0.125%	1.65%	Nil
1½ hours	0.140%	2.0%	Nil
2 hours	0.080%	2.4%	Nil
8/3/28.			
Fasting	0.060%	0.60%	Nil
½ hour	0.160%	1.10%	Nil
1 hour	0.130%	1.40%	Nil
1½ hours	0.075%	2.00%	Nil
2 hrs	0.075%	2.50%	Nil



6/3/28.			
Fasting	.075%	Trace	Nil
½ hour	0.150%	0.55%	Nil
1 hour	0.140%	1.55%	Nil
1½ hours	0.135%	1.55%	Nil
2 hours	0.085%	1.00%	Nil
7/3/28.			
Fasting	0.065%	Trace	Nil
½ hour	0.140%	Trace	Nil
1 hour	0.125%	1.65%	Nil
1½ hours	0.140%	2.0%	Nil
2 hours	0.080%	2.4%	Nil
8/3/28.			
Fasting	0.060%	0.60%	Nil
½ hour	0.160%	1.10%	Nil
1 hour	0.130%	1.40%	Nil
1½ hours	0.075%	2.00%	Nil
2 hrs	0.075%	2.50%	Nil



6/3/28.

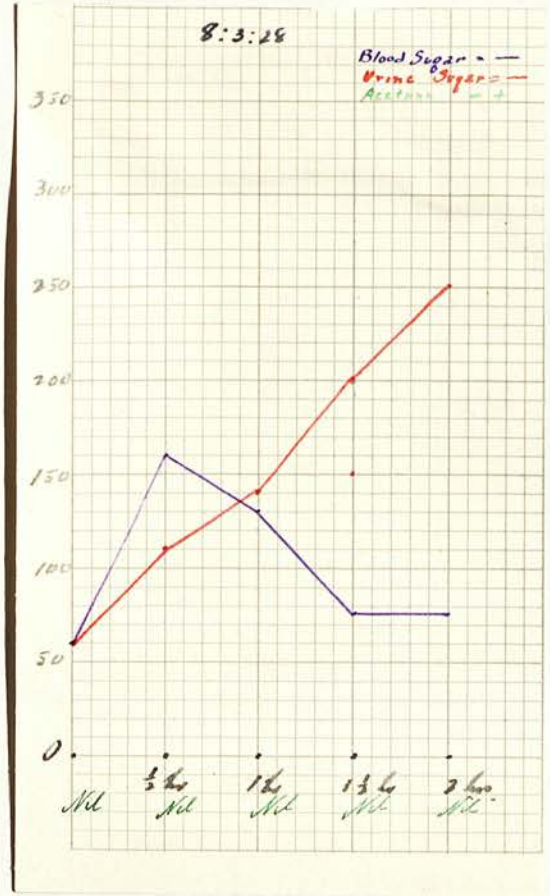
Fasting	.075%	Trace	Nil
½ hour	0.150%	0.55%	Nil
1 hour	0.140%	1.55%	Nil
1½ hours	0.135%	1.55%	Nil
2 hours	0.085%	1.00%	Nil

7/3/28.

Fasting	0.065%	Trace	Nil
½ hour	0.140%	Trace	Nil
1 hour	0.125%	1.65%	Nil
1½ hours	0.140%	2.0%	Nil
2 hours	0.080%	2.4%	Nil

8/3/28.

Fasting	0.060%	0.60%	Nil
½ hour	0.160%	1.10%	Nil
1 hour	0.130%	1.40%	Nil
1½ hours	0.075%	2.00%	Nil
2 hrs	0.075%	2.50%	Nil



Note the improvement in three successive days. The ingestion of 50 grammes of glucose daily has taken the place of an ordinary diet over a more extended period.

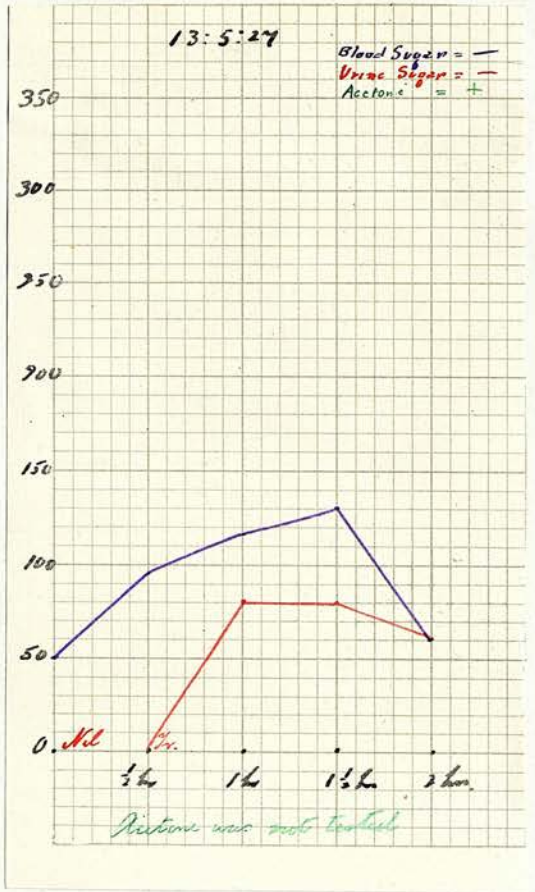
(d).

Mr. B. Clinical diabetes, polyneuritis, cramp, etc.

<u>13/5/27.</u> After 2 days of ordinary diet.

Fasting	.050%	Nil
½ hour	.095%	Trace
1 hour	.115%	.8%
1½ hours	.130%	.8%
2 hours	.060%	.6%

This curve is not diabetic.



18/5/27. After 7 days of ordinary diet.

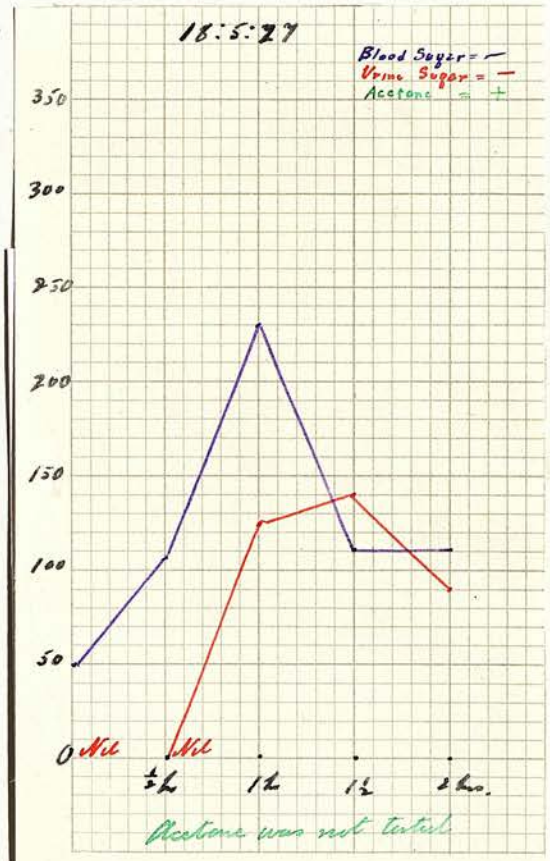
Fasting	.050%	0
½ hour	.105%	0
1 hour	.230%	1.25%
1½ hours	.110%	1.4%
2 hours	.110%	.9%

Note the increase of urine sugar and the rise in blood sugar after 1 hour, falling by 1½ hours. Partial exhaustion of pancreas by prolonged ordinary diet.

19/5/27. After 8 days ordinary diet.

Fasting	.100%	Trace
½ hour	.140%	Trace
1 hour	.180%	1.3%
1½ hours	.160%	1.6%
2 hours	.080%	2.0%

Note that while the figure at 1 hour is



18/5/27. After 7 days of ordinary diet.

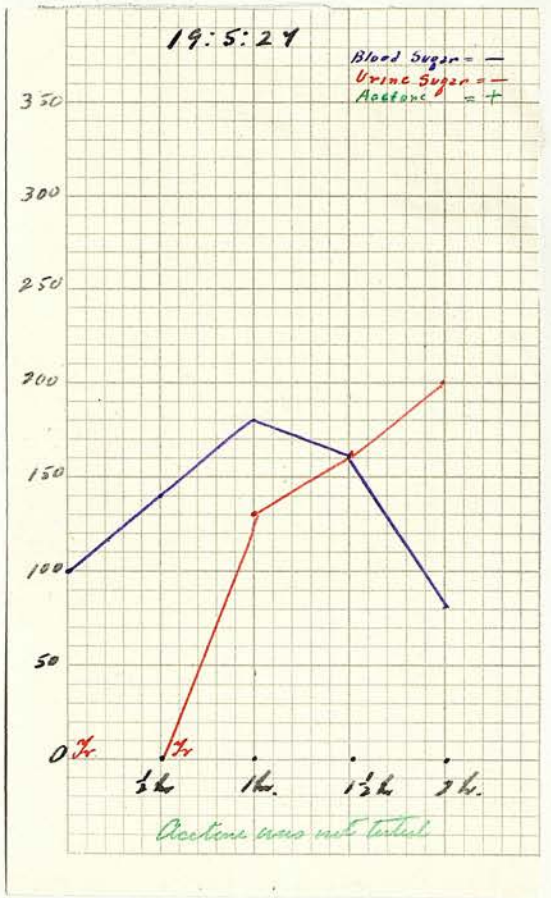
Fasting	.050%	0
½ hour	.105%	0
1 hour	.230%	1.25%
1½ hours	.110%	1.4%
2 hours	.110%	.9%

Note the increase of urine sugar and the rise in blood sugar after 1 hour, falling by 1½ hours. Partial exhaustion of pancreas by prolonged ordinary diet.

19/5/27. After 8 days ordinary diet.

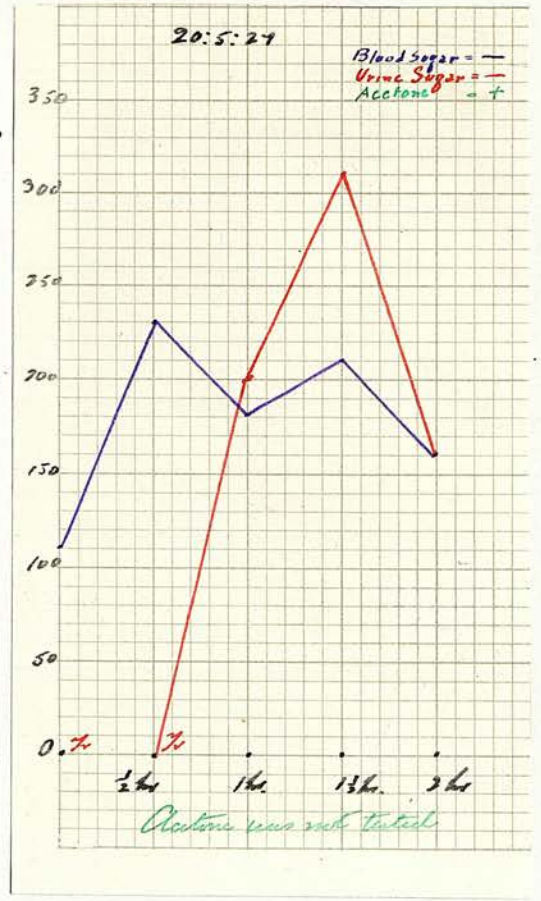
Fasting	.100%	Trace
½ hour	.140%	Trace
1 hour	.180%	1.3%
1½ hours	.160%	1.6%
2 hours	.080%	2.0%

Note that while the figure at 1 hour is



less than in the previous curve the drop after 1½ hrs. is not so marked and the fasting figure is higher while the last 3 figures of urine sugar are also higher.

The pancreas is feeling the strain of 100 grammes of glucose in 2 days plus ordinary food.



20/5/27. After 9 days of ordinary diet.

Fasting	.110%	Trace
½ hour	.230%	Trace
1 hour	.180%	2.0%
1½ hours	.210%	3.1%
2 hours	.160%	1.6%

A comparison of the curve of 18/5/27 and the above shows a deterioration due to the "Breaking down of the pancreas" after three days ingestion of 50 grammes of glucose daily plus ordinary diet.

(e).

Association of diabetes with duodenal or gastric ulcer.

Mr. R., X-Ray picture points to duodenal ulcer and colonic stasis.

On admission to hospital was taking 109.5 grammes of carbohydrate daily and

Blood Sugar Fasting = 0.185%

10 a.m. = 0.185%

Noon = 0.160%

No acetone in urine.

Sugar + + + + in urine.

15/2/28. Sugar tolerance test performed on a diet of fish and unrestricted carbohydrate.

Fasting	.105%	Trace
½ hour	.215%	1.65%
1 hour	.240%	2.1%
1½ hours	.270%	2.35%
2 hours	.180%	3.2%

The above is a curve of severe diabetes.

From Feby. 19th. to 17th March, he was given McLean's gastric diet and alkaline treatment.

On 28th March on 148.5 grammes carbohydrate.

B.S. F. = .065%
" = .085%
0.115%

No acetone.

Urine sugar + only.

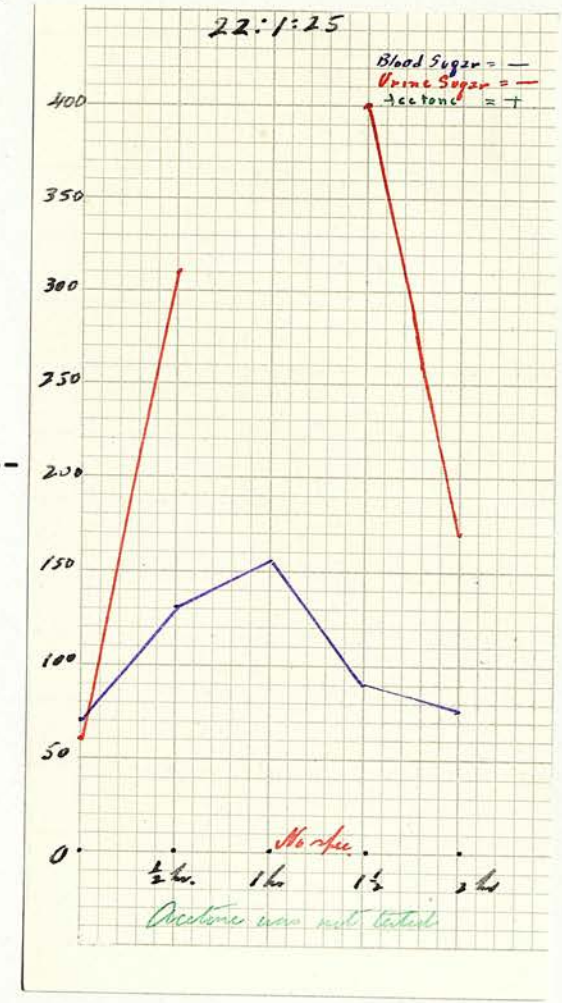
As his gastric condition improved the tolerance for carbohydrate improved also.

(f).

Mr. M. Case of renal glycosuria with pyloric stenosis and duodenal ulcer.

22/1/25. On a diet of restricted carbohydrate.

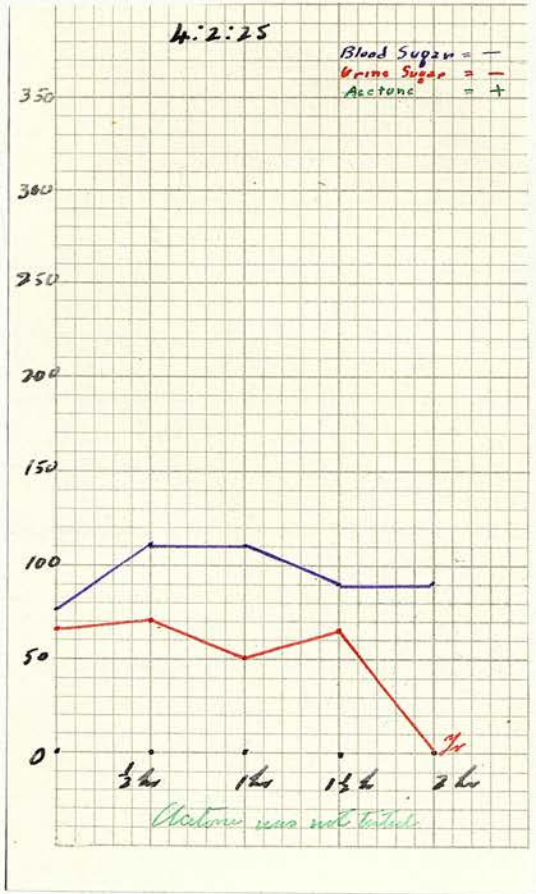
Fasting	.070%	.6%
½ hour	.130%	3.1%
1 hour	.155%	No specimen
1½ hours	.090%	4.0%
2 hours	.075%	1.7%



4/2/25. On ordinary diet since last test.

Fasting	.075%	.65%
½ hour	.110%	.7%
1 hour	.110%	.5%
1½ hours	.090%	.65%
2 hours	.090%	Trace

This shows the ordinary improvement in renal glycosuria after ordinary diet. The duodenal condition remained as before.



Renal glycosuria is an interesting condition very much bound up in the treatment of diabetes.

I have already indicated the numerous fallacies about S.T.Ts. in this condition.

In the absence of any clinical symptoms I should be very loath to be dogmatic on urine findings only. As I have endeavoured to point out, however, it is often very difficult to decide once the patient has been under any form of dietetic restriction.

The following points may be noted about such cases. They are usually of the nervous introspective type and are naturally very much worried by their condition. Until the condition has been discovered, often by routine urinalysis, there are no symptoms complained of. Once the nervous introspective glycosuric has been informed of his condition, and especially if he is in contact with cases of real diabetes, he begins to complain of polyuria, cramps and pruritus, and I think does not willingly deceive his doctor in regard to these matters. If there is any question of compensation or pension the picture is of course much more accentuated. If the patient's glycosuria is discovered thus by accident and he can immediately have a fasting Blood sugar taken and begin a series of sugar tolerance tests before any dietetic restriction has begun, the diagnosis

is usually fairly easy. Once the dietetic restrictions have commenced the altered curve and the presence of ketones in the urine due to carbohydrate restriction make the diagnosis more difficult. In such a case the clinician may have to take the patient into hospital and try the effect of ordinary diet, checking the patient's blood sugar every day or so for a week and if ketosis disappears and the blood sugar figures are satisfactory under this treatment he may safely proceed to a sugar tolerance test. If this is satisfactory the ordinary diet can be continued and a series of three successive sugar tolerance tests performed. This will usually clinch the diagnosis. If the condition be found before any dietetic restrictions have taken place and the fasting blood sugar figures are satisfactory, it may be possible to proceed direct to the three day sugar tolerance test and having done so clear up the matter at once. If one is in doubt however, it may be better to increase the patient's carbohydrate intake very gradually over a period of months or even years, noting the effect on his general condition.

Having decided the case is one of renal glycosuria, the patient should be advised to eat a normal diet and even a slight excess of carbohydrate to make up for

his "kidney leak" if such it be. This is a somewhat difficult matter after years of restriction and it is often necessary to reassure the patient by having him tested at yearly intervals for a few years.

Of the surgical treatment of diabetes I can only mention the case described by M. Dinate and quoted in the British Medical Journal of November 30th. 1929.

C O N C L U S I O N S:

The successful treatment of diabetes depends on the co-operation of the clinician and the laboratory with, in addition, an accurate and exact knowledge of the patient's food intake. The co-operation of the patient is also essential and he must rigidly follow the path set out for him by his physician. The best results are obtained by a food intake and an Insulin dosage so balanced as to keep the patient at or slightly above his standard weight, with if possible a normal fasting blood sugar value. The value of Insulin lies not only in the reduction of hyperglycaemia but is a safeguard against future retinitis, gangrene and cataract.

The path of the diabetic is a narrow one and deviation from his routine either by illness or

carelessness may be fatal. A system of after care and examination at regular intervals is essential.

I am indebted to the Director General of Medical Services, Ministry of Pensions, and to Dr. Willmore, my late "Chief", for permission to use the figures quoted in this article.